



TETRA TECH

October 31, 2014

Ms. Susan Fisher
On-scene Coordinator
U.S. Environmental Protection Agency – TLC
8600 NE Underground Drive, Pillar 253
Kansas City, Missouri 64161

**Subject: Quality Assurance Project Plan, Removal Assessment
Atlantic Water Supply Site, Atlantic, Iowa
CERCLIS ID No. IAD039954300
U.S. EPA Region 7 START 4, Contract No. EP-S7-13-06, Task Order No. 0030
Task Monitor: Susan Fisher, On-scene Coordinator**

Dear Ms. Fisher:

Tetra Tech Inc. is submitting the attached Quality Assurance Project Plan for Removal Assessment activities at the Atlantic Water Supply site in Atlantic, Cass County, Iowa. If you have any questions or comments, please contact David Zimmermann at (816) 412-1788.

Sincerely,

David Zimmermann, CHMM
START Project Manager

Ted Faile, PG, CHMM
START Program Manager

Enclosures



**QUALITY ASSURANCE PROJECT PLAN
FOR A REMOVAL ASSESSMENT
ATLANTIC WATER SUPPLY SITE
ATLANTIC, IOWA**

CERCLIS ID: IAD039954300

**Superfund Technical Assessment and Response Team (START) 4 Contract
Contract No. EP-S7-13-06, Task Order 0030**

Prepared For:

U.S. Environmental Protection Agency
Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

October 31, 2014

Prepared By:

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**Region 7 Superfund Program
Addendum to the QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012)
for the Atlantic Groundwater Site**

Project Information:

Project Name: Atlantic Groundwater Site		City: Atlantic	State: IA
EPA Project Manager: Susan Fisher		START Project Manager: David Zimmermann	
Approved By: <i>[Signature]</i>	Title: START Project Manager	Date: 10/31/14	Prepared For: EPA Region 7 Superfund Division
Approved By: <i>[Signature]</i>	Title: START Program Manager	Date: 10/31/14	
Approved By: <i>[Signature]</i>	Title: START QA Manager	Date: 10/31/14	Prepared By: David Zimmermann
Approved By:	Title: EPA Project Manager	Date:	Date: October 2014
Approved By:	Title: EPA Region 7 QA Manager	Date:	Tetra Tech START Project Number: X9025.14.0030.000

1.0 Project Management:

1.1 Distribution List

EPA—Region 7: Susan Fisher, EPA Project Manager
Diane Harris, EPA Region 7 QA Manager

Tetra Tech START: David Zimmermann, Project Manager
Kathy Homer, QA Manager

1.2 Project/Task Organization

Susan Fisher, of the EPA Region 7 Superfund Division, will serve as the EPA Project Manager for the activities described in this QAPP. David Zimmermann, of Tetra Tech, Inc., will serve as the START Project Manager for field activities.

1.3 Problem Definition/Background:

Description: This site-specific Quality Assurance Project Plan form is prepared as an addendum to the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012), and contains site-specific data quality objectives for the sampling activities described herein.

☒ Description attached.

☐ Description in referenced report: _____
Title Date

1.4 Project/Task Description:

☐ CERCLA PA ☐ CERCLA SI ☐ Brownfields Assessment ☐ Removal Action
☐ Other (description attached): ☐ Pre-CERCLIS Area Screening ☒ Removal Site Evaluation

Other Description:

Schedule: Field activities are scheduled to begin in December 2014 and are anticipated to take 5 days to complete.

☐ Description in referenced report: _____
Title Date

1.5 Quality Objectives and Criteria for Measurement Data:

Accuracy:	<input checked="" type="checkbox"/> Identified in attached table.
Precision:	<input checked="" type="checkbox"/> Identified in attached table.
Representativeness:	<input checked="" type="checkbox"/> Identified in attached table.
Completeness*:	<input checked="" type="checkbox"/> Identified in attached table.
Comparability:	<input checked="" type="checkbox"/> Identified in attached table.

Other Description:

*A completeness goal of 100 percent has been established for this project. However, if the completeness goal is not met, EPA may still be able to make decisions based on any or all of the remaining validated data.

1.6 Special Training/Certification Requirements:

☒ OSHA 1910 ☐ Special Equipment/Instrument Operator (describe below): ☐ Other (describe below):
Geoprobe Operator licensed in Iowa

1.7 Documentation and Records:

☒ Field Sheets ☒ Daily Log ☐ Trip Report ☒ Area Maps ☐ Video
☒ Chain of Custody ☒ Health and Safety Plan ☒ Letter Report ☒ Photos

☒ Sample documentation will follow EPA Region 7 SOP 2420.05.

☒ Other: Analytical information will be handled according to procedures identified in Table 2.

Region 7 Superfund Program Addendum to the QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012) for the Atlantic Groundwater Site			
2.0 Measurement and Data Acquisition:			
2.1 Sampling Process Design:			
<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> Random Sampling </div> <div style="width: 50%;"> <input type="checkbox"/> Transect Sampling </div> <div style="width: 50%;"> <input checked="" type="checkbox"/> Biased/Judgmental Sampling </div> <div style="width: 50%;"> <input type="checkbox"/> Stratified Random Sampling </div> <div style="width: 50%;"> <input type="checkbox"/> Search Sampling </div> <div style="width: 50%;"> <input type="checkbox"/> Systematic Grid </div> <div style="width: 50%;"> <input type="checkbox"/> Systematic Random Sampling </div> <div style="width: 50%;"> <input checked="" type="checkbox"/> Definitive Sampling </div> <div style="width: 50%;"> <input type="checkbox"/> Screening w/o Definitive Confirmation </div> <div style="width: 50%;"> <input type="checkbox"/> Screening w/ Definitive Confirmation </div> <div style="width: 50%;"> <input checked="" type="checkbox"/> Sample Map Attached </div> </div>			
<input checked="" type="checkbox"/> Other (Provide rationale behind each sample): See Appendix A for additional sampling information.			
<p>The proposed sampling scheme will be biased/judgmental with definitive laboratory analysis, in accordance with the <i>Guidance for Performing Site Inspections Under CERCLA</i>, Office of Solid Waste and Emergency Response (OSWER) Directive #9345.1-05, September 1992, and <i>Removal Program Representative Sampling Guidance, Volume 1: Soil</i>, OSWER Directive 9360.4-10, November 1991. Judgmental sampling is the subjective (based) selection of sampling locations based on historical information, visual inspection, and the best professional judgment of the sampler(s). See Appendices A and B for additional site-specific information and maps.</p>			
<p>The proposed number of samples was determined by the EPA Project Manager, and represents a reasonable attempt to meet the study objectives while staying within the budget constraints of the project.</p>			
Sample Summary Location	Matrix	# of Samples*	Analysis
Source Soils	Soil	48	Volatile Organic Compounds
*NOTE: Quality control (QC) samples are not included with these totals. See Table 1 for a complete sample summary.			
2.2 Sample Methods Requirements:			
Matrix	Sampling Method	EPA SOP(s) or other Method	
Soil	Soil samples will be collected with Geoprobe® macro-core samplers using a stop-pin system. Samplers will be equipped with polyvinyl chloride (PVC) liners and, upon collection; soil will be transferred to the appropriate sample containers.	SOP 4231.2012, 4230.07; Method 5035	
<input type="checkbox"/> Other Description:			
2.3 Sample Handling and Custody Requirements:			
<input checked="" type="checkbox"/> Samples will be packaged and preserved in accordance with procedures defined in Region 7 EPA SOP 2420.06. <input checked="" type="checkbox"/> COC will be maintained as directed by Region 7 EPA SOP 2420.04. <input checked="" type="checkbox"/> Samples will be accepted according to Region 7 EPA SOP 2420.01. <input type="checkbox"/> Other (Describe): Samples submitted to a START-contracted laboratory will be accepted in accordance with procedures established by the laboratory.			
2.4 Analytical Methods Requirements:			
<input checked="" type="checkbox"/> Identified in attached table. <input checked="" type="checkbox"/> Rationale: The requested analyses have been selected based on historical information about the site and program experience with similar types of sites. <input type="checkbox"/> Other (Describe):			
2.5 Quality Control Requirements:			
<input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/> Identified in attached table. <input checked="" type="checkbox"/> In accordance with the Generic Quality Assurance Project Plan for Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input checked="" type="checkbox"/> Field QC Samples: For this investigation, field QC samples will include one trip blank (water). The trip blank will be prepared by the EPA Region 7 laboratory and be used to evaluate contamination introduced during transportation of the containers/samples. All QC samples will be submitted for the analyses listed in the attached tables. Evaluation of whether the environmental samples are representative depends on a comparison of levels of contamination found in blank samples with levels of contamination found in environmental samples. Analytical results from blank samples will be evaluated on a qualitative basis by the EPA Project Manager and EPA contractor(s) to determine a general indication of field-introduced and/or lab-introduced contamination. Because evaluation of total method precision is not necessary for this project, no field duplicates will be collected. <input type="checkbox"/> Other (Describe):			

Region 7 Superfund Program Addendum to the QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012) for the Atlantic Groundwater Site	
2.6	Instrument/Equipment Testing, Inspection, and Maintenance Requirements: <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/> In accordance with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input checked="" type="checkbox"/> Testing, inspection, and maintenance of analytical instrumentation will accord with the previously referenced SOPs and/or manufacturers' recommendations. Testing, inspection, and maintenance of field instruments (water quality meter, Global Positioning System [GPS] unit, etc.) will accord with manufacturers' recommendations.
2.7	Instrument Calibration and Frequency: <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/> In accordance with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input checked="" type="checkbox"/> Calibration of laboratory equipment will proceed as described in the previously referenced SOPs and/or manufacturers' recommendations. <input checked="" type="checkbox"/> Other (Describe): Calibration of field instruments (water quality meter, etc.) will accord with manufacturers' recommendations.
2.8	Inspection/Acceptance Requirements for Supplies and Consumables: <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/> In accordance with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input checked="" type="checkbox"/> All sample containers will meet EPA criteria for cleaning procedures for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA in <i>Specifications and Guidelines for Obtaining Contaminant-Free Containers</i> . <input type="checkbox"/> Other (Describe):
2.9	Data Acquisition Requirements: <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/> In accordance with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input checked="" type="checkbox"/> Previous data or information pertaining to the area (including other analytical data, reports, photos, maps, etc., that are referenced in this QAPP) has been compiled by EPA and/or its contractor(s) from other sources. Some of that data has not been verified by EPA and/or its contractor(s); however, that unverified information will not be used for decision-making purposes by EPA without verification by an independent professional qualified to verify such data or information. <input type="checkbox"/> Other (Describe):
2.10	Data Management: <input checked="" type="checkbox"/> All laboratory data acquired will be managed in accordance with Region 7 EPA SOP 2410.01. <input type="checkbox"/> Other (Describe): Management of laboratory data acquired by the START-contracted laboratory will accord with procedures established by the laboratory.
3.0 Assessment and Oversight:	
3.1	Assessment and Response Actions: <input checked="" type="checkbox"/> Peer Review <input checked="" type="checkbox"/> Management Review <input type="checkbox"/> Field Audit <input type="checkbox"/> Lab Audit <input checked="" type="checkbox"/> Assessment and response actions pertaining to analytical phases of the project are addressed in Region 7 EPA SOPs 2430.06 and 2430.12. <input type="checkbox"/> Other (Describe): Assessment and response actions pertaining to analytical phases of the project will accord with procedures established by the START-contracted laboratory (to be determined).
3.1A	Corrective Action: <input checked="" type="checkbox"/> Corrective actions will be at the discretion of the EPA Project Manager whenever problems appear that could adversely affect data quality and/or resulting decisions affecting future response actions pertaining to the area. <input type="checkbox"/> Other (Describe):
3.2	Reports to Management: <input type="checkbox"/> Audit Report <input type="checkbox"/> Data Validation Report <input type="checkbox"/> Project Status Report <input type="checkbox"/> None Required <input checked="" type="checkbox"/> A letter report describing the sampling techniques, locations, problems encountered (with resolutions to those problems), and interpretation of analytical results will be prepared by START and submitted to the EPA. <input checked="" type="checkbox"/> Reports will be prepared in accordance with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012). <input type="checkbox"/> Other (Describe):

<p align="center">Region 7 Superfund Program Addendum to the QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012) for the Atlantic Groundwater Site</p>	
<p align="center">4.0 Data Validation and Usability:</p>	
4.1	<p>Data Review, Validation, and Verification Requirements:</p> <p><input type="checkbox"/> Identified in attached table.</p> <p><input checked="" type="checkbox"/> Data review and verification will accord with the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (updated October 2012).</p> <p><input checked="" type="checkbox"/> Data review and verification will be performed by a qualified analyst and the laboratory's section manager as described in Region 7 EPA SOPs 2430.06, 2430.12, and 2410.10.</p> <p><input type="checkbox"/> Other (Describe):</p>
4.2	<p>Validation and Verification Methods:</p> <p><input type="checkbox"/> Identified in attached table.</p> <p><input checked="" type="checkbox"/> The data will be validated in accordance with Region 7 EPA SOPs 2430.06, 2430.12, and 2410.10.</p> <p><input checked="" type="checkbox"/> The EPA Project Manager will inspect the data to provide a final review. The EPA Project Manager will review the data, if applicable, for laboratory spikes and duplicates, laboratory blanks, and field QC samples to ensure the data are acceptable. The EPA Project Manager will also compare the sample descriptions with the field sheets for consistency, and will ensure appropriate documentation of any anomalies in the data.</p> <p><input type="checkbox"/> Other (Describe):</p>
4.3	<p>Reconciliation with User Requirements:</p> <p><input checked="" type="checkbox"/> If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded, and re-sampling or re-analysis of the subject samples may be required by the EPA Project Manager.</p> <p><input type="checkbox"/> Other (Describe):</p>

Region 7 Superfund Program Addendum to the Generic QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012) for the Atlantic Water Supply Site							
Table 1: Sample Summary							
Site Name: Atlantic Water Supply Site				Location: Atlantic, IA; see Appendix B, Figure 1			
START Project Manager: David Zimmermann				Activity/ASR #: To be determined		Date: October 2014	
No. of Samples	Matrix	Location	Purpose	Depth or other Descriptor	Requested Analysis	Sampling Method	Analytical Method/SOP
48	Soil	Suspected source areas	To identify extent of VOC contamination in source soils	At each geoprobe location, soils will be collected from three depths; between 8-9, 19-20 and 27-28 feet below ground surface	VOCs	EPA SOP 4231.2012, 4230.07 & EPA Method 5035	EPA Method 5035
QC Samples							
1	Water	Trip blank	To assess field/transportation-related contamination	N/A	VOCs	N/A	EPA SOP 3230.13

Region 7 Superfund Program Addendum to the Generic QAPP for the Superfund Site Assessment and Targeted Brownfields Assessment Programs (October 2012) for the Atlantic Water Supply Site								
Table 2: Data Quality Objective Summary								
Site Name: Atlantic Water Supply Site				Location: Atlantic, IA; see Appendix B, Figure 1				
START Project Manager: David Zimmermann				Activity/ASR #: To be determined				Date: October 2014
Analysis	Analytical Method	Data Quality Measurements					Sample Handling Procedures	Data Management Procedures
		Accuracy	Precision	Representativeness	Completeness	Comparability		
Soil								
VOCs	See Table 1	Per analytical method	Per analytical method	Judgmental sampling based on professional judgment of the sampling team	100%; no critical samples have been identified	Standardized procedures for sample collection and analysis will be used.	See Section 2.3 of QAPP form.	See Section 2.10 of QAPP form.

APPENDIX A

SITE-SPECIFIC INFORMATION REGARDING A REMOVAL ASSESSMENT AT THE ATLANTIC WATER SUPPLY SITE

INTRODUCTION

The Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) has been tasked by the U.S. Environmental Protection Agency (EPA) Region 7 Superfund Division to conduct Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal assessment activities at the Atlantic Water Supply site in Atlantic, Cass County, Iowa. The site includes a tetrachloroethene (PCE) groundwater contamination plume that appears to be originating from an abandoned dry cleaners and has impacted a number of municipal wells about 0.5 mile northwest. The site was initially investigated by EPA's pre-remedial program in the late 1980s. Since that time, the site has undergone a number of followup investigations, including a removal assessment in the mid-1990s that involved identification of the source of contamination through installation of 13 Geoprobe® direct push technology (DPT) soil borings, and installation and sampling of three permanent monitoring wells. In 2005, a hydrogeologic investigation evaluated the feasibility of installing a permeable reactive barrier wall. During this investigation, six deep borings were advanced by use of a drill rig to develop a vertical profile of groundwater contamination in the Cretaceous-age Dakota Sandstone bedrock aquifer near the City's well field. In 2011, a site reassessment determined current groundwater concentrations and reevaluated the site by use of the Hazard Ranking System. In 2012 and 2013, a removal reassessment investigation was completed in which a source was delineated, groundwater samples were collected by use of Geoprobe® temporary wells, municipal wells and piezometers were sampled, and sub-slab vapor and indoor air samples were collected. Additional subsurface soil sample were collected in March and June of 2013. Following this investigation, groundwater modeling was conducted in August 2013 to predict plume concentration and movement in the future (Battelle 2013).

As specified by the START task order and subsequent conversations with the EPA Region 7 On-scene Coordinator, this activity will involve installation of 16 additional soil borings in an attempt to fully delineate the extent of soil contamination at the source. Angled borings will be used to assess soil under the professional office building at the west side of the parking lot. Boring to the north, west and south will be installed vertically. This Quality Assurance Project Plan (QAPP) identifies site-specific features and addresses elements of the sampling strategy and analytical methods proposed for this investigation.

SITE LOCATION/DESCRIPTION

Atlantic is a rural community in the northeastern portion of Cass County, Iowa, about 75 miles west of Des Moines, Iowa, and 45 miles northeast of Council Bluffs, Iowa. The 2010 census population for the community was 7,112. The apparent source of contamination at the Atlantic Water Supply site is at 1205

East 7th Street, also known as U.S. Highway 6 or State Highway 83 (see Appendix B, Figure 1). A former dry cleaning facility, the Norge Dry Cleaning Village, operated at this location during the 1960s. Approximate coordinates of the former dry cleaner are latitude 41.403718° north and longitude 94.995763° west. Though exact dates of operation are not known, the dry cleaning facility was listed in the 1962 Atlantic City Directory (Atlantic, Iowa 1962). This facility also was used from 1960 to 1974 by Shrauger Appliance as an appliance retailing facility. In 1974, the Iowa Department of Transportation (IDOT) leased the site as a materials testing laboratory. IDOT relocated its operation in March 1986 to a site east of the City. It is suspected that the dry cleaning operations and IDOT routinely used solvents (Ecology & Environment, Inc. [E&E] 1988).

Based on historical aerial photographs of the site (Historical Information Gatherers [HIG] 2003), the building that housed the former dry cleaner/IDOT laboratory facility was razed between 1982 and 1994. The property is now owned by the Rolling Hills Bank and Trust. Land use surrounding the site is a mix of commercial and residential properties. The City of Atlantic's municipal well field is approximately 0.50 mile northwest of the former dry cleaner location. Public utilities are operated by Atlantic Municipal Utilities (AMU).

The municipal water supply well field in Atlantic, Iowa, has been impacted by PCE (Tetra Tech EM Inc. 2004). At the source, approximately 40 feet of silt and clay overlies fine- to coarse-grained friable sandstone from which the well field withdraws the City's potable water supply. The silt and clay soils have been contaminated with PCE that has migrated to the underlying Dakota Sandstone aquifer used by the City of Atlantic for its municipal water supply.

The PCE contamination continues to migrate downward into the sandstone aquifer, and then to travel horizontally within this aquifer to the City's municipal well field. The well nearest to the source area (AMU Well No. 7) was first found to contain PCE in 1982 (reported at a concentration of 170 micrograms per liter [$\mu\text{g/L}$]) (E&E 1988). AMU Well No. 7 was disconnected from the system and is now pumped continually by the local water authority wastewater treatment plant in order to provide hydraulic control and protect nine other municipal wells from contamination. Currently, nine active municipal wells serve the 7,112 citizens of Atlantic, Iowa. Eight municipal wells (AMU well Nos. 10 through 17) are on the north side of Troublesome Creek between 0.5 and 1 mile from the former dry cleaner site. AMU well Nos. 6 and 7 are on the south side of the creek. Total depths of the nine active municipal wells range from approximately 75 to 98 feet below ground surface (bgs), with an average of 87 feet bgs. Other wells previously present on the south side of the creek (AMU Well Nos. 1 through 5 and 8 and 9) have since been decommissioned due to their age and diminishing performance. AMU well No. 6, approximately

910 feet northeast of AMU well No. 7, is also contaminated with PCE (approximately 10 to 15 µg/L or less), which signifies the overall width of the PCE contaminant plume. AMU well No. 6 is still used as a drinking water well and is pumped approximately 15 to 20 hours per day at 300 to 350 gallons per minute (gpm) on average. Water from the nine active municipal wells is initially blended and then treated.

PREVIOUS INVESTIGATIONS

During a water quality survey by the Iowa Department of Natural Resources (IDNR) in August 1982, PCE was detected in AMU Well No. 7 (AMU-7) at a concentration of 170 µg/L. Subsequent IDNR sampling events detected PCE in AMU-7 at concentrations ranging from 11 µg/L in March 1995 (IDNR 1999) to 260 µg/L in August 1984 (E&E 1988). The maximum contaminant level (MCL) for PCE is 5 µg/L. From August 1982 to November 1987, water from AMU-7 was pumped to an intermittent creek in an attempt to prevent migration of the PCE contamination to other nearby drinking water supply wells (E&E 1988). In December 1987, the discharge from AMU-7 was rerouted to the 3rd Street sanitary sewer line about 150 feet southwest of the well for treatment at the City of Atlantic's wastewater treatment facility (E&E 1988).

In August 1987, an EPA contractor conducted a soil gas survey to delineate the approximate extent of PCE contamination. Soil gas samples were collected from a depth of 5 to 6 feet bgs at 55 locations. Analytical results suggested the source area was just south of East 7th Street, about 250 feet east of the former dry cleaning and IDOT laboratory facility (E&E 1988). The report stated that a release of PCE likely had occurred at the former dry cleaning and IDOT laboratory facility, and had migrated via surface runoff and groundwater flow to this topographic low. According to the report, the migration of PCE from the source area may have followed the storm sewer system along the southern side of East 7th Street (E&E 1988).

In August and November 1998, the Iowa Department of Natural Resources (IDNR) conducted followup investigations of the PCE contamination to better define the source. During these investigations, 34 soil gas samples and 10 soil samples were collected for analysis. IDNR analyzed the soil samples for PCE utilizing a mobile laboratory and using a headspace analysis method. The sampling focused on the area of the former dry cleaning and IDOT laboratory facility, and the source area identified during the 1987 EPA investigation. Soil gas data from the IDNR investigations confirmed the level of PCE contamination originally detected in 1987. However, significantly higher PCE levels (greater than 10,000 parts per million) were detected near the former dry cleaning and IDOT laboratory facility. Based on these findings, IDNR concluded that contamination in the silty, clayey soil beneath the former dry cleaning and

IDOT laboratory facility is the predominant source of PCE impacting the groundwater (IDNR 1999). The report indicated that soils appeared to be contaminated to a depth of at least 20 feet bgs. The report also recommended installing monitoring wells to better define the extent of PCE contamination in groundwater near the suspected source area.

From 2002 through 2004, Tetra Tech START conducted a removal site evaluation (RSE) of the Atlantic Water Supply site. Field activities included advancement of 13 soil borings to depths ranging from 23 to 36 feet bgs (Tetra Tech EM Inc. 2004). These borings were advanced around the previously identified source area and sampled to aid in determining the extent of contamination. In addition, three permanent, flush-mounted monitoring wells (MW) were installed into the Dakota Sandstone at depths ranging from 40.5 to 50 feet bgs. These wells were installed to assess groundwater quality near the source area. All three wells extend about 10 feet into the Dakota Sandstone. In soils, PCE was reported at its highest concentrations near the former dry cleaner. PCE was found at concentrations as high as 5,100 micrograms per kilogram ($\mu\text{g}/\text{kg}$) in a sample collected from 28 feet bgs. In the monitoring wells PCE was found at 5,300 $\mu\text{g}/\text{L}$ in the well installed near the former dry cleaner (Tetra Tech EM Inc. 2004).

In 2005, personnel from the EPA Environmental Response Team (ERT) and the Response Engineering and Analytical Contract (REAC) conducted a hydrogeologic investigation at the site (Lockheed Martin Technology Services 2005). The primary purpose of the investigation was to define the nature and extent of groundwater contamination upgradient of the municipal well field in order to assess the applicability of installing a permeable reactive barrier (PRB) for groundwater treatment and protection. As part of the investigation, six boreholes were installed about 150 feet upgradient (south) of contaminated AMU Well No. 7 at the approximate centerline of the proposed PRB wall. Borehole depths ranged from 76 to 87.5 feet bgs, and were installed into the upper sandstone bedrock by use of sonic drilling techniques. Multiple groundwater samples were collected at each boring. In all, 28 groundwater samples were collected. PCE was reported in water samples from all six borings, with the highest concentration (446 $\mu\text{g}/\text{L}$) found in the boring farthest east (Lockheed Martin Technology Services 2005). The eastern extent of the plume near the well field was not delineated in that investigation, and remains undefined. Following the investigation, preliminary cost estimates to install a PRB were calculated. The total costs for this remedial technology were prohibitive to implement under the removal program.

In December 2011, as part of a site reassessment, START collected groundwater samples from three monitoring wells near the source (Tetra Tech EM Inc. 2012). Groundwater samples were also collected from nine active municipal wells and a former municipal well (AMU-7) that is now pumped to waste to contain the plume. PCE (2,500 $\mu\text{g}/\text{L}$) and *cis*-1,2-dichloroethene (3.8 $\mu\text{g}/\text{L}$) were identified in samples

collected from the monitoring well at the former dry cleaners. In AMU-7, PCE and trichloroethene (TCE) were reported at 87 and 1.3 µg/L, respectively. Concentrations have decreased with time in both the monitoring well and at AMU-7, but remain well above health-based benchmarks. The only active municipal well that contained any site-related contaminants was AMU-6, where PCE was reported at 3.6 µg/L.

The removal reassessment in October 2012 focused primarily on characterization of the source area. The investigation consisted primarily of a membrane interface probe (MIP) assessment of soils, with confirmation sampling and analysis by the EPA Region 7 Laboratory. Geoprobe groundwater samples were also collected at 12 locations, as well as groundwater samples from three municipal wells and one city piezometer. Subsequent sampling activities by EPA and START personnel characterized sub-slab vapors and indoor air concentrations, further defined the extent of soil contamination, and developed a better understanding of the lithology at the source area. In January 2013, EPA collected sub-slab vapor samples at two locations under the Professional Services building west of the former drycleaners. In February 2013, EPA collected additional sub-slab and crawl space samples, as well as indoor air samples at the Professional Services building and Rolling Hills Bank building. To further define the extent of soil contamination, START collected additional soil samples from 10 Geoprobe borings in March 2013. Also in March, one indoor air sample was collected. In May, 2013, two deep soil borings were installed by use of roto sonic drilling techniques, and START collected groundwater samples from various intervals at each boring. PCE was found in groundwater from the onsite boring at concentrations ranging from 14,000 µg/L at 39 feet bgs to 79 µg/L at 83 feet bgs. In June 2013, START collected soil samples from three Geoprobe soil borings on the north side of East 7th Street and PCE was detected in one boring at concentrations as high as 61 µg/kg (Tetra Tech 2013). Figure 2 in Appendix B depicts soil samples collected in the vicinity of the source area and concentrations of PCE reported.

ENVIRONMENTAL SETTING

Sources of groundwater in the area of Cass County include alluvial valley aquifers, glacial-drift aquifers, and the Dakota Formation (U.S. Geological Survey [USGS] 1992). The alluvial aquifers are primarily made up of deposits along existing river valleys. The nearest alluvial valley to Atlantic is the east fork of the Nishnabotna River and its tributary, Troublesome Creek. The aquifer underlying the valley is relatively shallow, with an average depth of 21 feet, and is composed of fine-grained alluvial deposits. Thickness ranges from approximately 2 to 43 feet. Groundwater can also be obtained from shallow glacial-drift aquifers, consisting of glacial and loess deposits over bedrock. In the Atlantic area, these deposits range in thickness from 18 to 260 feet. Although the water table is usually shallow, production

rates in the glacial-drift aquifers are often limited due to low soil permeability. Neither the alluvial nor the glacial drift aquifers are used for groundwater production in the Atlantic area.

The City of Atlantic draws its water solely from the Nishnabotna Member of the Dakota Formation. The Dakota is a fine- to coarse-grained sandstone, very poorly cemented (friable), partly pebbly to conglomeratic, and locally interbedded with seams of clay (IDNR 1996). Secondary lithologies include chert-quartz gravel, conglomerate, and gray to variegated mudstone with some siderite pellets. The formation is approximately 40 to 60 feet thick in the Atlantic wellhead protection area, providing abundant pore space for groundwater storage. Within the wellhead protection area, the Dakota is upwardly confined by clay-rich glacial till.

The aquifer is recharged by downward percolation through Pleistocene deposits and by lateral groundwater inflow from southwest Minnesota. Regional groundwater flow is from north to south, and natural discharge from the aquifer occurs into the lower reaches of major rivers in the region. Locally, groundwater flows from south to north (the direction of PCE migration), which results from a combination of topography and groundwater pumping from the municipal well field.

At the source, measured static water level (SWL) was 40.16 feet bgs in 2002 and 34.98 feet bgs in 2001. Closer to Troublesome Creek and the AMU well field, SWLs are above the Dakota Sandstone. In the six borings installed as part of the 2005 hydrogeologic investigation, SWLs were reported at approximately 1,135 feet above mean sea level, or about 22 feet bgs. In this area, the saturated thickness of the alluvium above the Dakota sandstone was from 10 to 15 feet.

Average hydraulic characteristics of the Dakota Formation in the wellhead protection area are as follows (USGS 1992):

- Transmissivity = 1,750 to 3,075 square feet per day
- Hydraulic conductivity = 35 to 60 feet per day
- Hydraulic gradient = 0.003 feet per foot.

Below the Dakota is an aquiclude of impermeable, calcareous, gray-blue-red shales, with interbedded limestones, belonging to the Missourian Series of Pennsylvanian age. These shales are encountered at a depth of 85 to 90 feet bgs, and are approximately 725 feet thick in the Atlantic area.

SAMPLING STRATEGY AND METHODOLOGY

The sampling activities are tentatively scheduled to begin in early December 2014, and will require approximately 5 days to complete. The July 26, 2013 removal reassessment report documented approximately 3,776 cubic yards of contaminated soil at the source. However the full extent has not been delineated. A preliminary removal action level of 60 µg/kg has been established and existing samples along the western edge of the mass show contamination as high as 1,100 µg/kg and samples along the northern edge of the mass show concentrations as high as 4,600 µg/kg (see Figure 2). Further characterization to the in all directions is required. Access to the west and north are hindered by an office building and East 7th Street (U.S. Highway 6). In order to characterize the soils under the building, angled boring will be required. Start will advance soil borings from locations as close to the building as possible and use the greatest angle possible. Conversations with DPT contractors indicate this angle is approximately 22 degrees. To characterize the soils under East 7th Street, START will coordinate with Department of Transportation to close lanes of traffic while sampling is conducted. START also proposed to conduct a geophysical survey of the parking lot during the field activities. START will subcontract this work to a vendor capable of performing ground penetrating radar surveys to locate any historic utility lines or underground tanks.

Two START members will be required to oversee DPT activities and sample collection. Sixteen Geoprobe® soil borings will be advanced to further define the horizontal extent of contamination in soil to the immediate north and west of the source area. At each boring, discrete samples will be collected at three depths. These depths are based on previously obtained electrical conductivity logs from the October 2012 sampling. At each boring location, soil samples will be collected from depths of 8 to 9 feet below ground surface (ft bgs), 19 to 20 ft bgs, and 27 to 28 ft bgs. At each proposed soil boring location, a 2-inch-diameter hole will be drilled through the concrete pavement. Soil cores will be collected using Geoprobe® macro-core soil samplers with a stop-pin system. The samples will be collected for analysis for VOCs. Sample collection procedures will follow guidelines established in the EPA Standard Operating Procedures (SOP) described in the original QAPP. Anticipated locations of the 16 additional borings are shown on Figure 3.

Soil samples will be submitted to the EPA laboratory for analysis for VOCs in accordance with EPA SW-846 Method 5035. Samples for laboratory analysis will consist of two 5-gram aliquots placed in two 40-milliliter vials preserved with sodium bisulfate, and two unpreserved 40-mL vials packed with soil. The DPT soil samples will be collected in accordance with EPA Region 7 SOP 4230.07: Geoprobe® Operations. Proposed is analysis of 48 soil samples via EPA Region 7 laboratory Standard Operating

Procedure (SOP) 3230.15. Standard detection limits and turnaround times for all analyses will be sufficient for the sampling activities.

Handling of investigation-derived wastes (IDW) is described below. Procedures for equipment and personal decontamination will be addressed in a site-specific health and safety plan prepared by Tetra Tech START. Most IDW is expected to consist of excess soil generated during sample collection, and disposable sampling supplies (gloves, paper towels, tubing, etc.) that will be disposed of off site as uncontaminated solid waste. Excess soil will be returned to the hole from which it came.

Pertinent data, including analyses to be performed and exact sample locations, will be recorded on field sheets for each sample. All samples will be stored in coolers maintained at temperatures at or below 4 degrees Celsius (°C) pending submittal to the EPA Region 7 laboratory.

Quality Control Samples

To evaluate sample quality control (QC), a water trip blank and field blank will be collected during the sampling event, as specified in Section 2.5 of the QAPP form. Because evaluating total method precision is not necessary for this project, no field duplicates will be collected.

ANALYTICAL METHODS

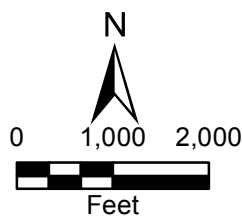
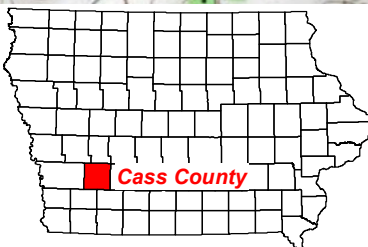
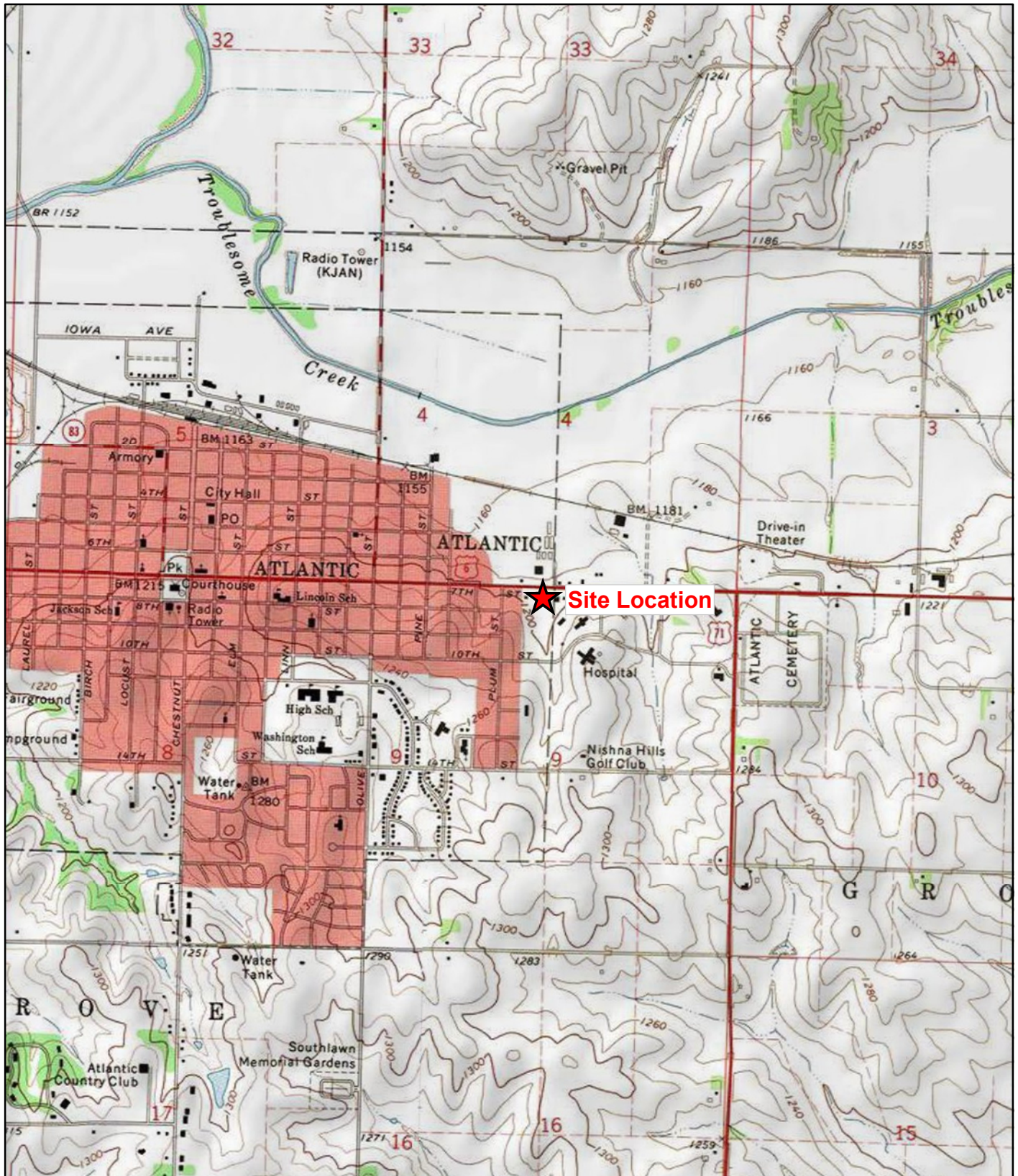
Soil samples will be submitted to the EPA Region 7 laboratory in Kansas City, Kansas, for analysis. The samples will be analyzed for VOCs in accordance with SOPs and methods referenced in the QAPP. Standard turnaround times and detection limits for those methods will be adequate for this project. Appropriate containers and physical/chemical preservation techniques will be employed during the field activities to help verify that representative analytical results are obtained. An Analytical Services Request form will be completed by the Tetra Tech START Project Manager and submitted to the EPA Region 7 laboratory. Submittal of samples to the laboratory is expected in December 2014.

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APPENDIX B

FIGURES



Atlantic Water Supply Site
Atlantic, Iowa

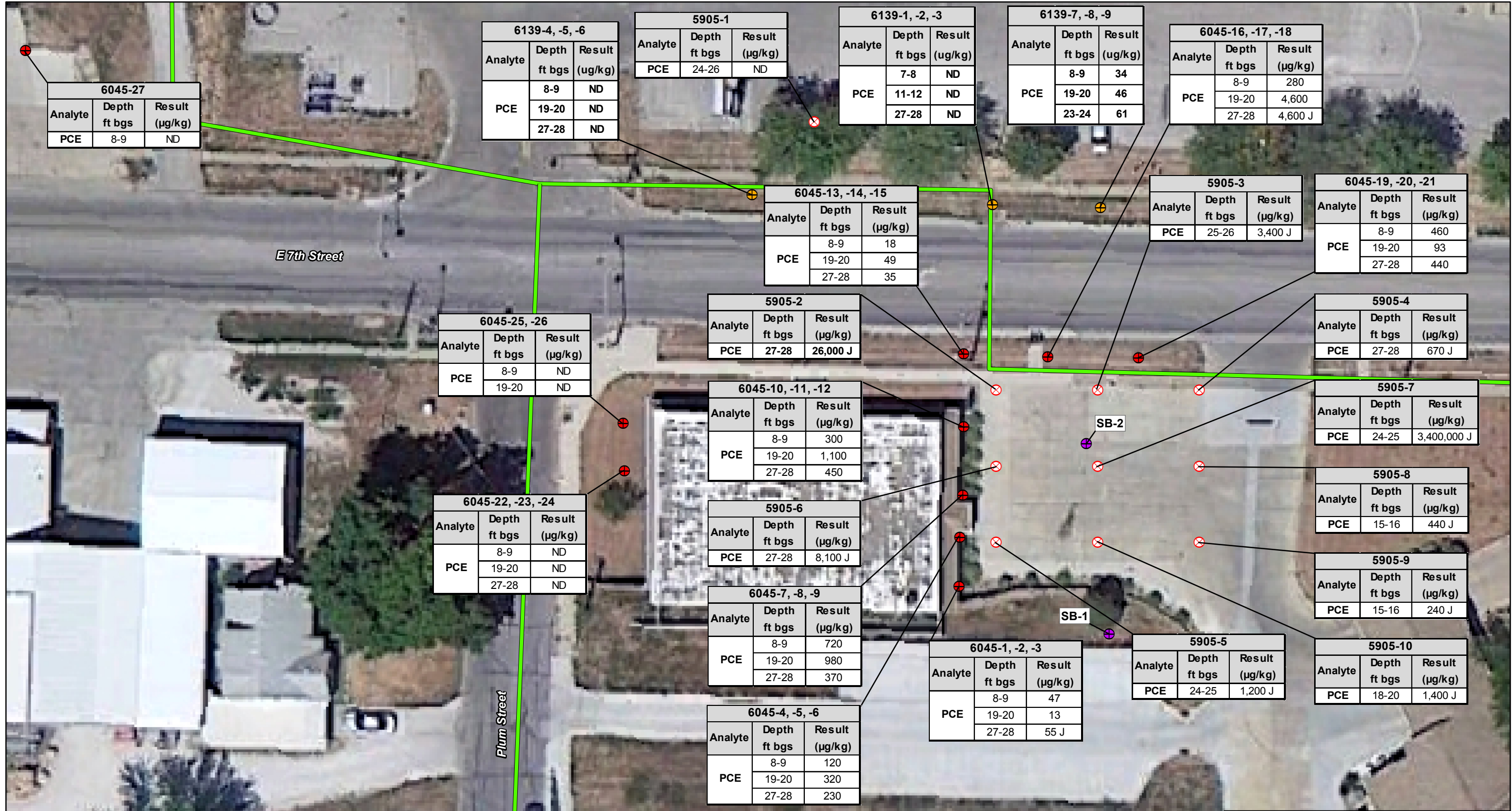
Figure 1
Site Location Map



Source: USGS Atlantic, Iowa 7.5 Minute Topo Quad, 1991
USGS Wiota, Iowa 7.5 Minute Topo Quad, 1971

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Legend

●

 Bedrock boring sample location - May 2013

⊕

 DPT soil sample location - March 2013

⊙

 DPT soil sample location - June 2013

⊗

 MIP profiling location - October 2012

—

 Sanitary sewer line

DPT

 Direct push technology

J

 Estimated value

ft bgs

 Feet below ground surface

MIP

 Membrane interface probe

µg/kg

 Micrograms per kilogram

ND

 Not detected

PCE

 Tetrachloroethene

N

01530

Feet

Atlantic Water Supply Site
Atlantic, Iowa

Figure 2
Soil Sampling Results Map

Tt

TETRA TECH

Date: 10/29/2014

Drawn By: Gustavo Orozco

Project No: X9025.L.14.0030.000

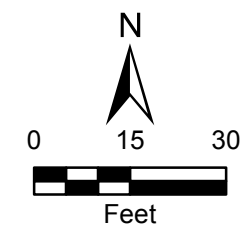
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Source: Google Earth Aerial Imagery, 2012



Legend

- ⊕ Past sample location
- Proposed soil boring sample location
- ➡● Proposed angular soil boring sample location
- Sanitary sewer line



Atlantic Water Supply Site
Atlantic, Iowa

Figure 3
Proposed Soil Sampling Locations Map



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